

Why Simulation and Why Distributed Simulation?

**Colonel Kenneth C. Konwin, USAF
Director
Defense Modeling and Simulation
Office**



Why Simulation?

The Problem: Complexity

Increased Complexity demands more practice, prototypes, and experimentation which the budget does not permit

**Complexity
of
Operations and Systems**

M&S can bridge the Gap by...

- Expanding Training Horizons
- Supporting a New Acquisition Paradigm
- Exploring New Technologies

Resources

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M&S is Critical to DoD's Ability to Meet its Mission

Continuing squeeze on DoD resources


- shrinking, dispersed force structure
- competition for funds limits field exercises
- need to carefully examine every investment

More demanding operational requirements

- new, more complex missions
- vastly expanding mission space
- increased complexity of systems and plans
- increasing demand for joint training
- security challenges (e.g., information warfare)

Much more technical capability at less cost

- communications
- computers
- software technology
- displays/human-machine interfaces
- data storage and management



**Advanced
M&S offers
a cost-effective
and affordable
solution**

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THE MACHINE THAT CHANGED THE WORLD

THE STORY OF
LEAN PRODUCTION

HOW JAPAN'S SECRET
WEAPON IN THE
GLOBAL AUTO WARS
WILL REVOLUTIONIZE
WESTERN INDUSTRY



JAMES P. WOMACK, DANIEL T. JONES, AND DANIEL ROOS

**HOW
JAPAN'S
SECRET
WEAPON
IN THE
GLOBAL
AUTO WARS
WILL
REVOLUTIONIZE
WESTERN
INDUSTRY**

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**No new idea springs full
blown from a void. Rather,
new ideas emerge from a set
of conditions
in which old ideas no longer
seem to work...**

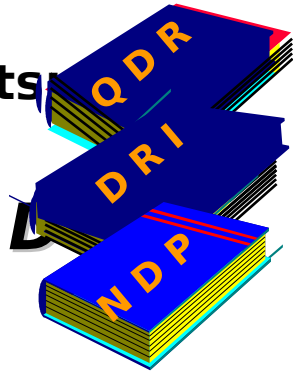
James Womack, Daniel Jones, and Daniel Roos, The Machine That Changed The World: The Story of Lean Production. New York: Harper Perennial, 1991.

Three Revolutions Are Occurring in DoD

1997: 3 Major
DoD

Documents

Q D R



What we Buy - Revolution in Military

- Joint Vision 2010 warfighting concepts
- Exploit technology to achieve
- Joint Experimentation

Common reform principle

- Focus enterprise on unifying vision
- Commit leadership team to change
- Focus on core competencies
- Streamline organizations for agility
- Invest in people
- Breakdown barriers between organizations
- Exploit info technology

QDR Quadrennial Defense Review

March 31, 1998
DMS
1998
Defense Reform Initiative
National Defense Panel



How we Buy - Revolution in Business

Affairs

Take advantage of Business process improvements pioneered in private sector

- A must, to maintain competitive edge in a changing global security



Why Distributed Simulation?

**“
...it is getting tougher and tougher all the
time
to train properly ... So we are pursuing
Distributed Mission Training.”**

**General Richard Hawley, USAF
Commander, Air Combat
Command**

I/ITSEC, December 4, 1997

We fight as an Air and Space Team, but we seldom train together as a

Air Force **D**istributed **M**ission **T**raining

..1996

.....1999

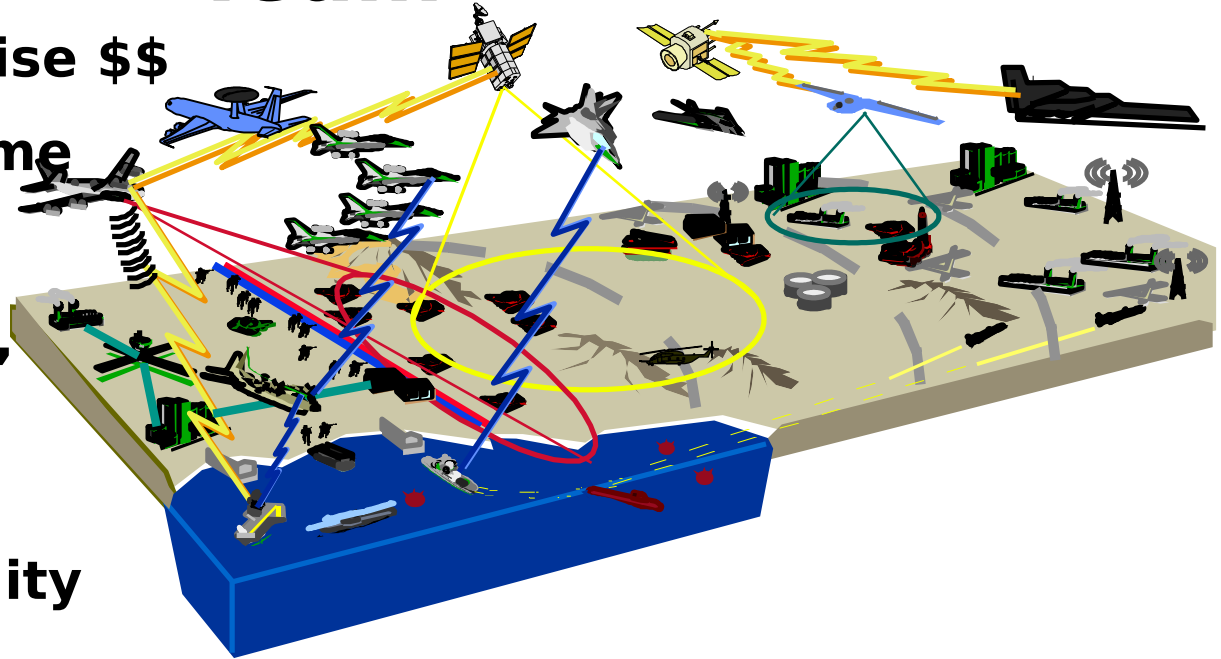
.....2003

.....2007

.....2010

Team

- Insufficient exercise \$\$
- Reduced flying time
- Security issues
- High PERSTEMPO, OPSTEMPO
- Safety
- Airspace availability
- Environmental concerns
- Restricted weapons/EW envelopes
- Complex rules of engagement



Distributed Mission Training

Supports Combat Training in a Joint Synthetic Battlespace

Air Force Distributed Mission Training

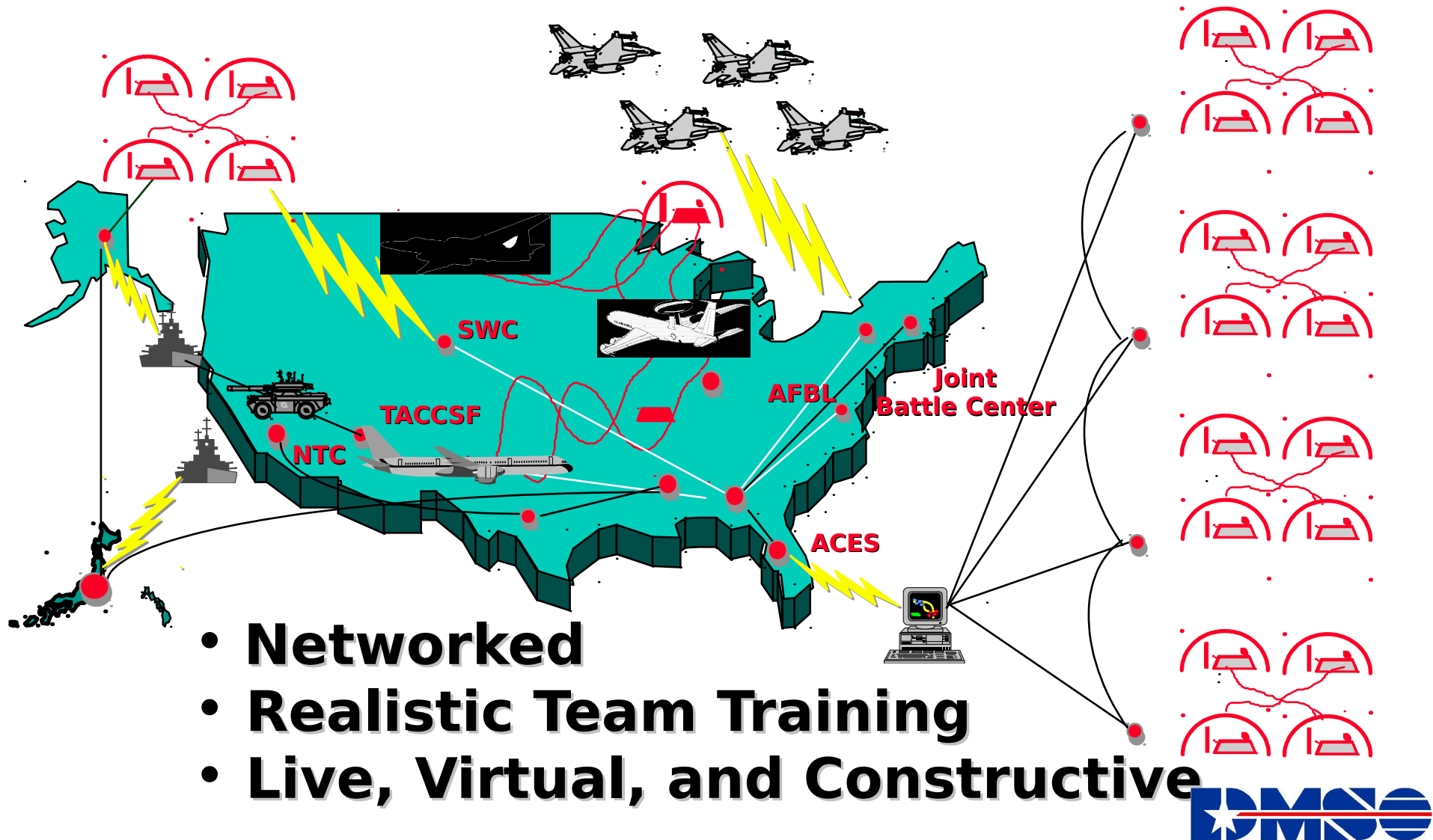
..1996

.....1999

.....2003

.....2007

.....2010



Why Distributed Simulation?

“The face of test and evaluation is changing, along with the acquisition process. The future is now, and distributed simulation is a big part of that future.”

**Dr. Marion Williams
Chief Scientist
Air Force Operational Test and Evaluation
Center**

Dr. Jacques S. Gansler

Under Secretary of Defense for Acquisition and Technology

“Techniques like simulation and modeling can help us ... by reducing the risk associated with new products and processes, by saving time in the development and production phase of new systems, and by making efficient use of scarce and increasingly expensive resources.”

**Precision Strike Association Annual Programs Review
May 19, 1998, Ft Belvoir**

Simulation Based Acquisition

...integrated across acquisition phases and programs...

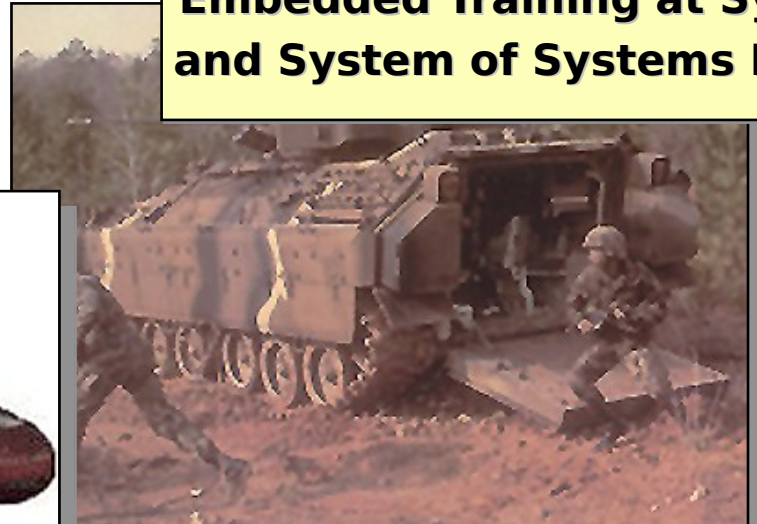
Total Ownership Lifecycle Support Up Front In Design



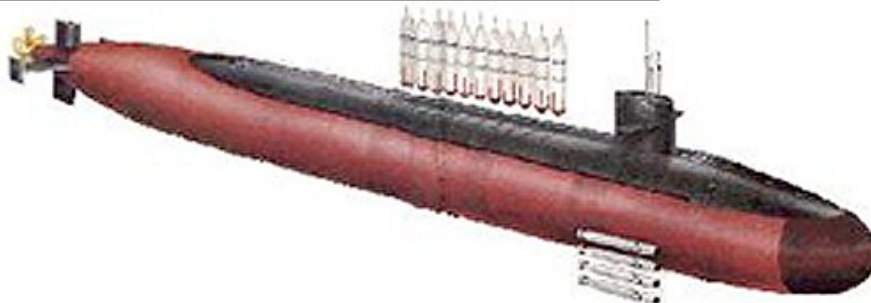
Comprehensive Exploration of Trade Space to Select Best Value Design



Embedded Training at System and System of Systems Levels



Seamless Transition from Design to Manufacturing



Total Product Life Cycle Ownership

AVIATION WEEK & SPACE TECHNOLOGY

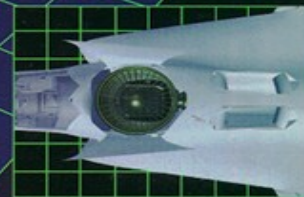
A PUBLICATION OF THE MCGRAW-HILL COMPANIES • \$5.00 • OCTOBER 6, 1997

Computers in Aerospace Seeking the Next Edge

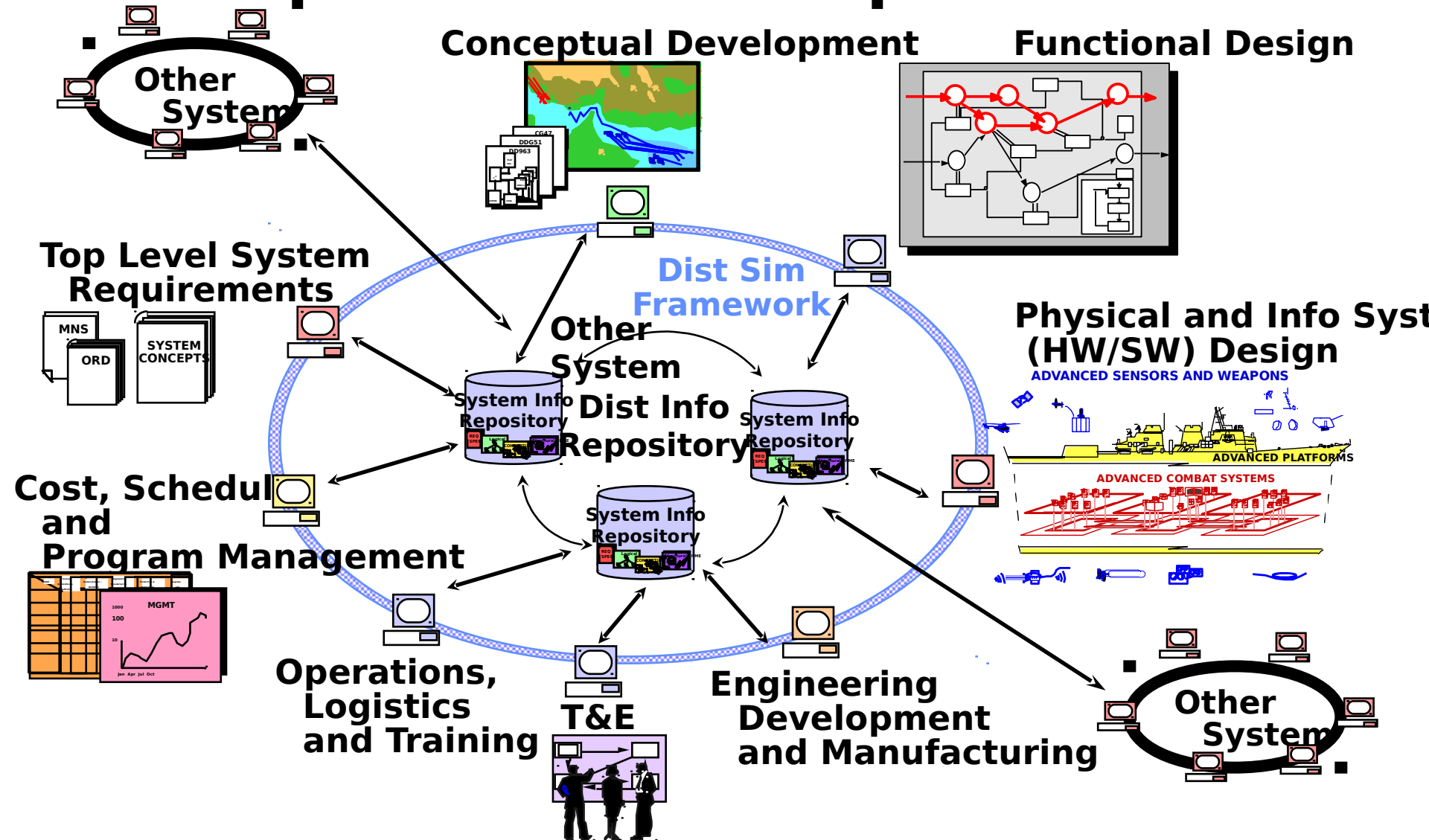
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New Warnings
on Loose Nukes



SBA Operations Concept Illustration



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Extensive Re-use Within Phases and Across Acquisition Process

Joint Experimentation *

"U.S. Atlantic Command's new role will focus our efforts to implement our future warfare vision ... The Services have individually made great strides in modeling and simulation, and other new techniques. Our challenge now is to integrate those efforts to achieve the greatest possible capabilities in the 21st century."

**General Henry H. Shelton, US
Chairman of the**

**Army
Joint Chiefs of Staff**

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* Extract from USACOM Joint Warfighting Experimentation Charter, Enclosure to Secretary of Defense memorandum designating US Atlantic Command (USACOM)



DoD M&S Vision

DoD Executive Council for Modeling and Simulation (EXCIMS), March 13, 1992

Defense modeling and simulation will provide readily-available, operationally-valid environments for use by DoD components

- to train jointly, develop doctrine and tactics, formulate operational plans, and assess war fighting situations
- as well as to support technology assessment, system upgrade, prototype and full scale development, and force structuring.

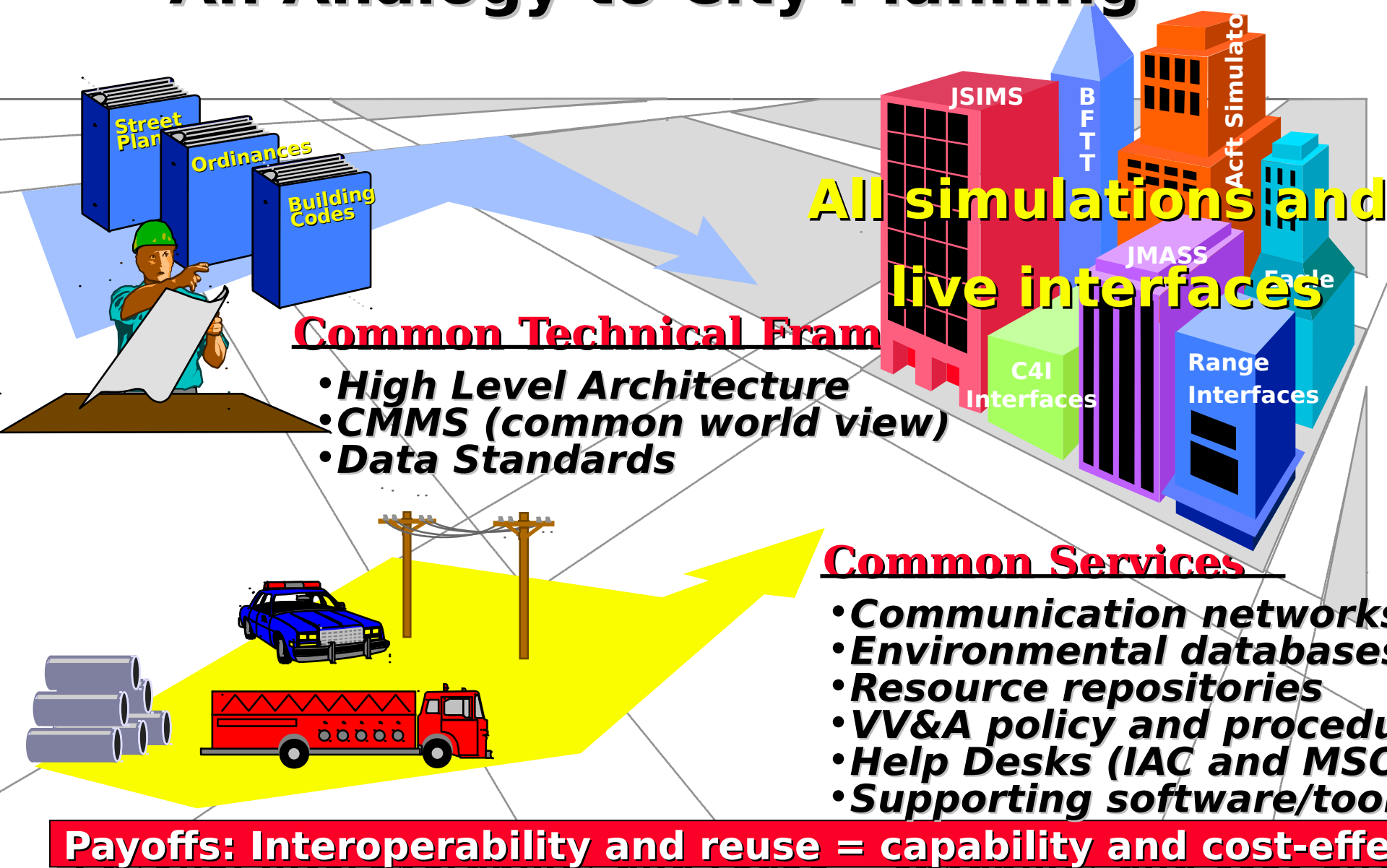
Furthermore, **common use of these environments** will promote a closer interaction between the operations and acquisition communities in carrying out their respective responsibilities. **To allow maximum utility and flexibility,**

th co Requires a “systems of systems” approach
interoperating through an open systems architecture.

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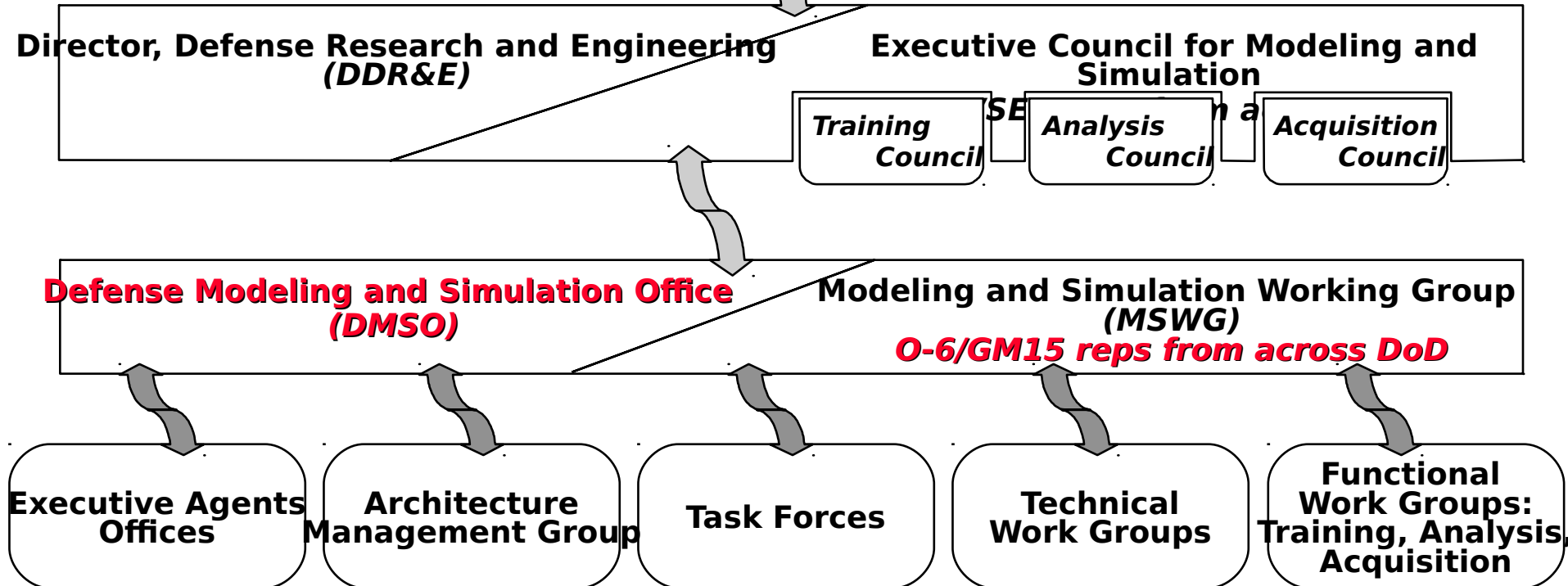


US DoD M&S Strategy: An Analogy to City Planning



DoD M&S Management Structure

Under Secretary of Defense (Acquisition and Technology)



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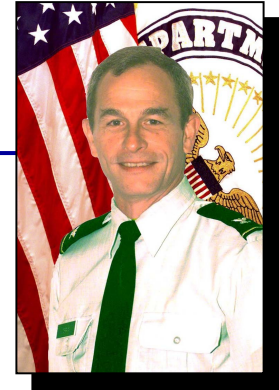




Gary Yerace
Chief of Staff



Col Crash Konwin
Director



COL Forrest Crain
Deputy Director



Dr. Judith Dahmann
Chief Scientist



CAPT (Sel) Dave Johnson
Chief, Operations



LtCol Mac McKeon
Chief, Tech. Applications



Waverly Debraux
Chief, Bus. & Fin. Mgmt.

DMSO's Mission: Key corporate-level functions necessary to achieve the DoD Vision for M&S

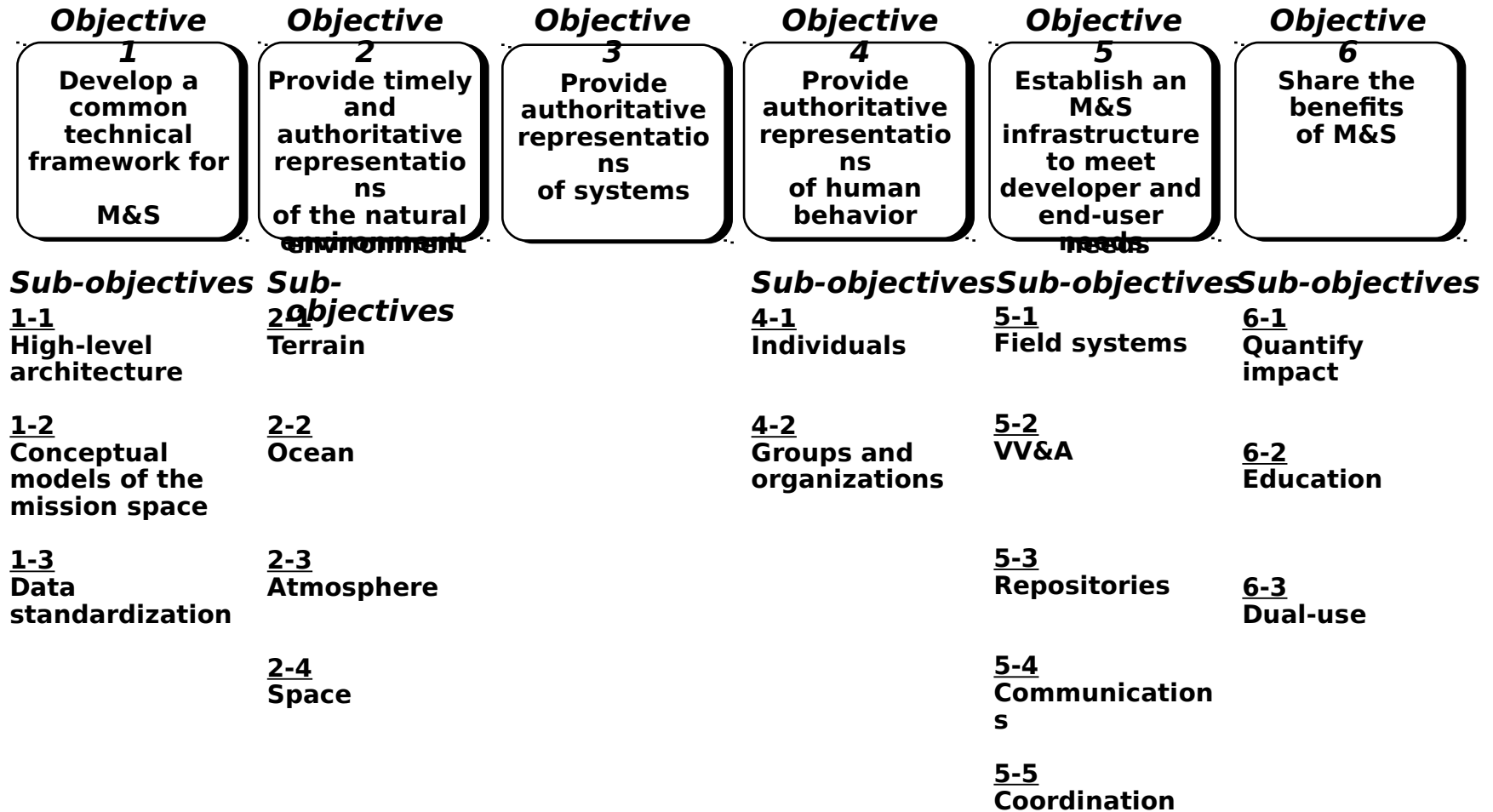
M&S responsibilities include

- **Manage DoD-M&S policies, directives and publications**
- **Lead establishment and maintenance of a common technical framework**
- **Provide, or coordinate provision of, broadly-useful common infrastructure, services, and tools to the M&S community**
- **Lead development of DoD plan for the development and exploration of M&S-related technology and execute such activities as appropriate**
- **Advise, and provide OSD oversight of, major simulation programs**
- **Foster cooperative M&S developments among DoD Components**

Represent DoD in commercial and international M&S-related organizations and standards bodies



The Strategy Is Being Executed Through a DoD-wide M&S Master Plan



DoD 5000.59-P, Modeling and Simulation Master Plan, October 1999

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JAMES P. WOMACK, DANIEL T. JONES, AND DANIEL ROOS

...The key to mass production wasn't... the moving, or continuous, assembly. Rather, it was the COMPLETE and consistent INTERCHANGEABILITY of parts and the simplicity of attaching them to each other...

James Womack, Daniel Jones, and Daniel Roos, The Machine That Changed The World: The Story of Lean Production. New York: Harper Perennial, 1991.

M&S Master Plan

Objective 1-1

- Establish **a common high-level simulation architecture** to facilitate the interoperability of all types of models and simulations among themselves and with C4I systems, as well as to facilitate the reuse of M&S components
- Simulations developed for particular DoD Components or Functional Areas must conform to the High Level Architecture
 - Further definition and detailed implementation of specific simulation system architectures remain the responsibility of the developing Component

Scope of HLA

- **Applicable to broad range of functional areas (e.g., training, contingency planning, analysis, and acquisition support)**
- **Applicable to simulations involving pure software representations, man-in-the-loop simulators, and interfaces to live components (e.g., instrumented weapon systems and C3 systems)**

The HLA provides a common architecture across a very wide set of simulation applications -- allowing for the reuse of tools, both government and commercial, across a broader range of users.

Representational Resources Thrusts

1. Models and Data

Authoritative Sources

Correlation/Consistency between Algorithms and Data

2. Information Exchange

Common Semantics and Syntax (CSS)

Data Interchange Formats (DIF)

3. Resource Production

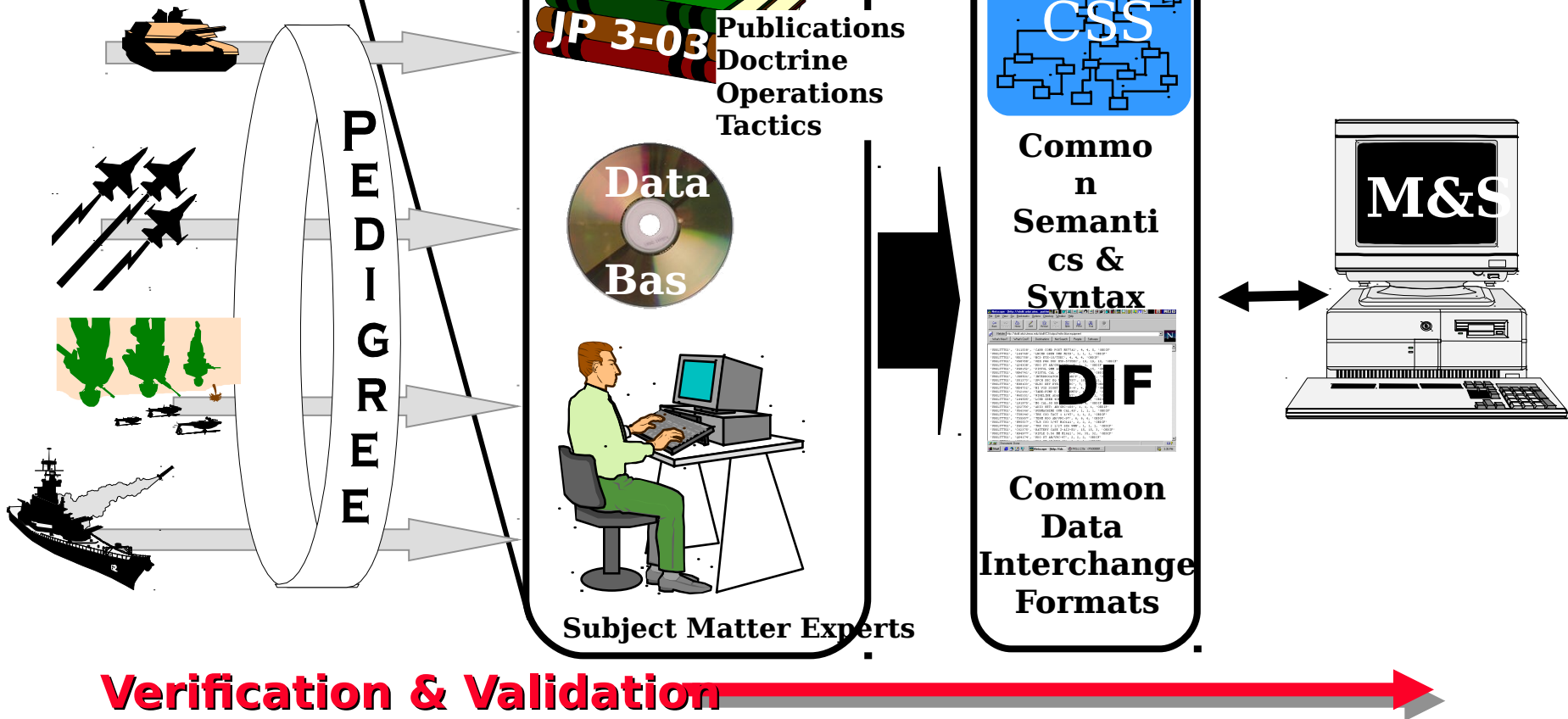
Just-In-Time Environmental Data

Data Quality Assurance Guidelines

Representational Resources Strategy

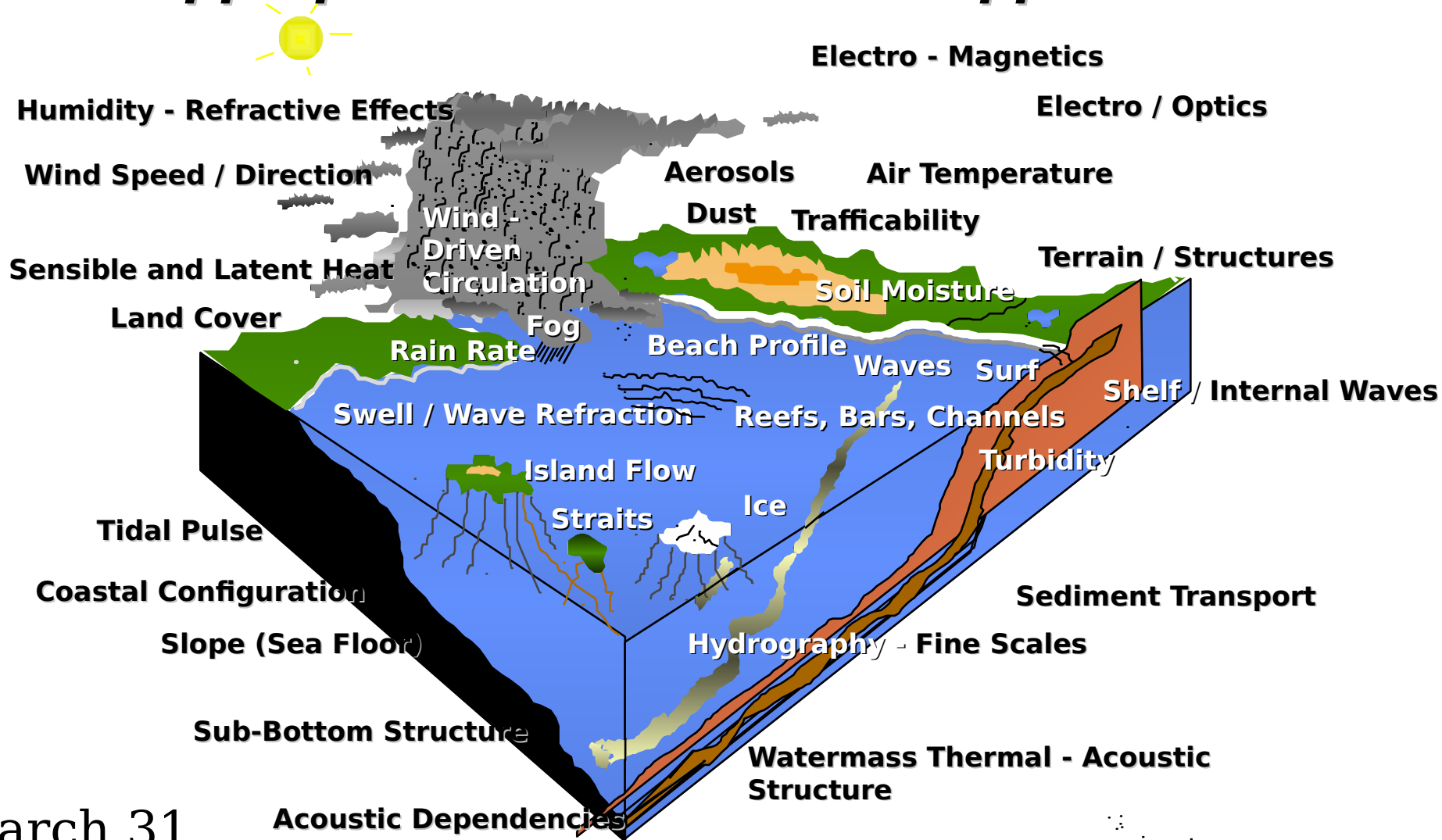
MSRR Libraries

Knowledge Collection



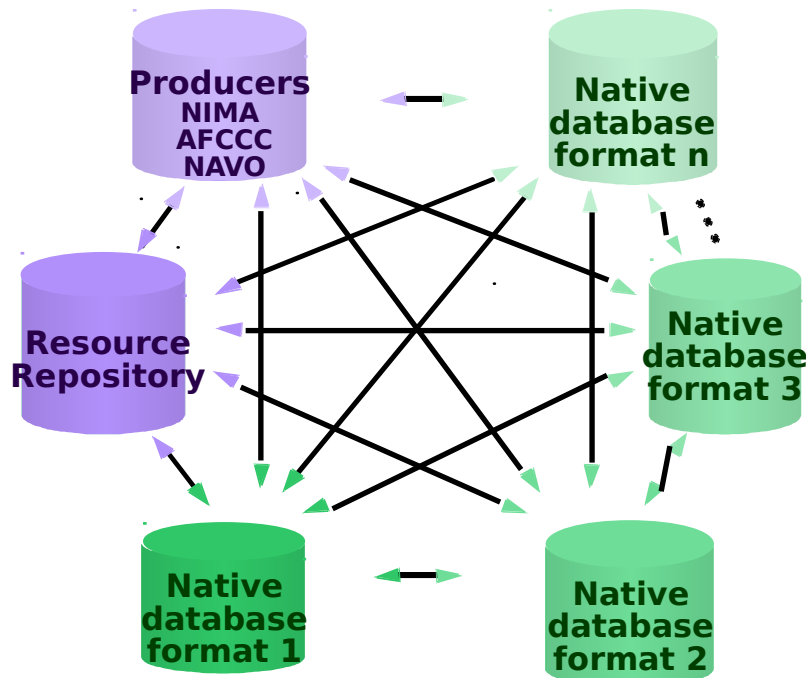
Environmental Representations - The Vision

An appropriate environment ... applied consistently

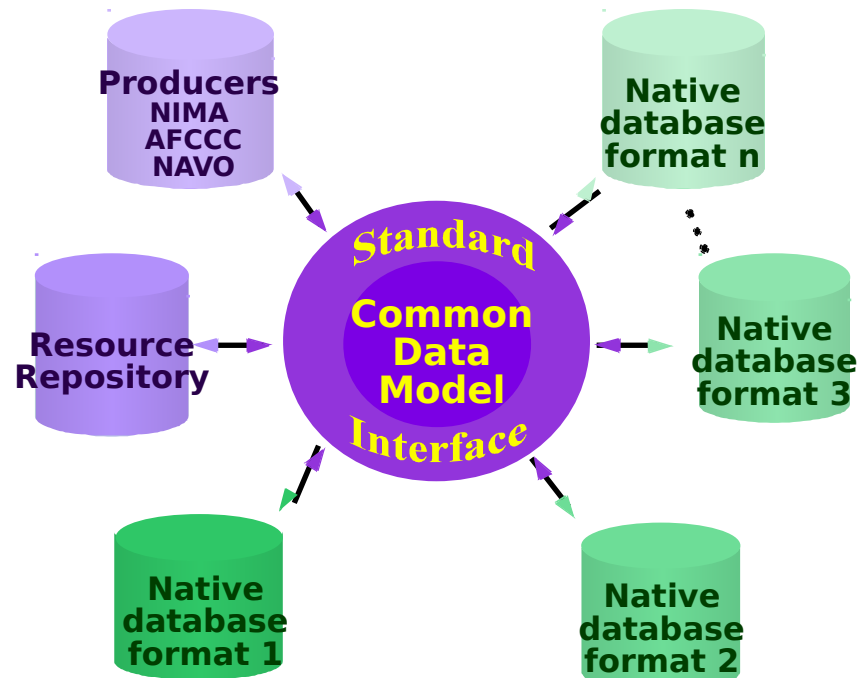


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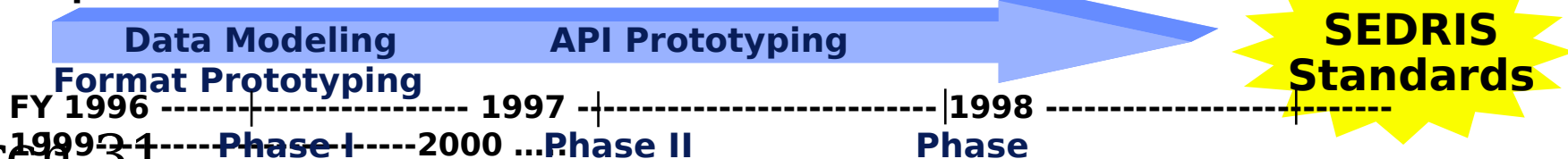
Synthetic Environment Data Representation & Interchange Specification (SEDRIS)



- No standard data model
- Limited support to heterogeneous simulation
- Indeterminant interchange mechanism
- Expensive database conversion

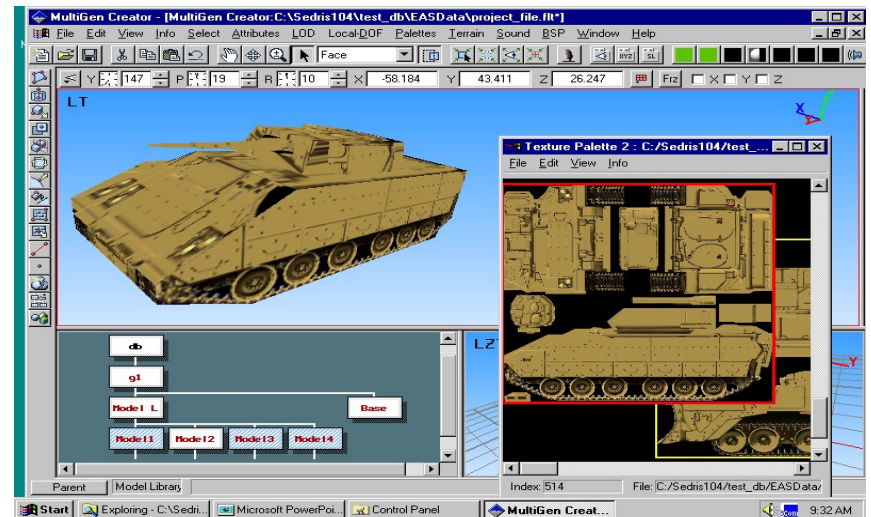
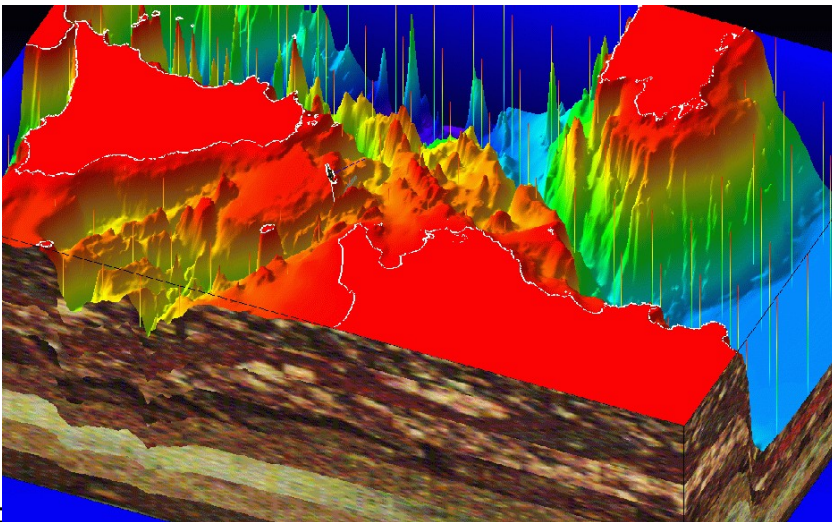


- Complete representation
- Enables interoperability
- Lossless and consistent interchange
- Reduction in conversion cost



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A Full Range of Applications ...



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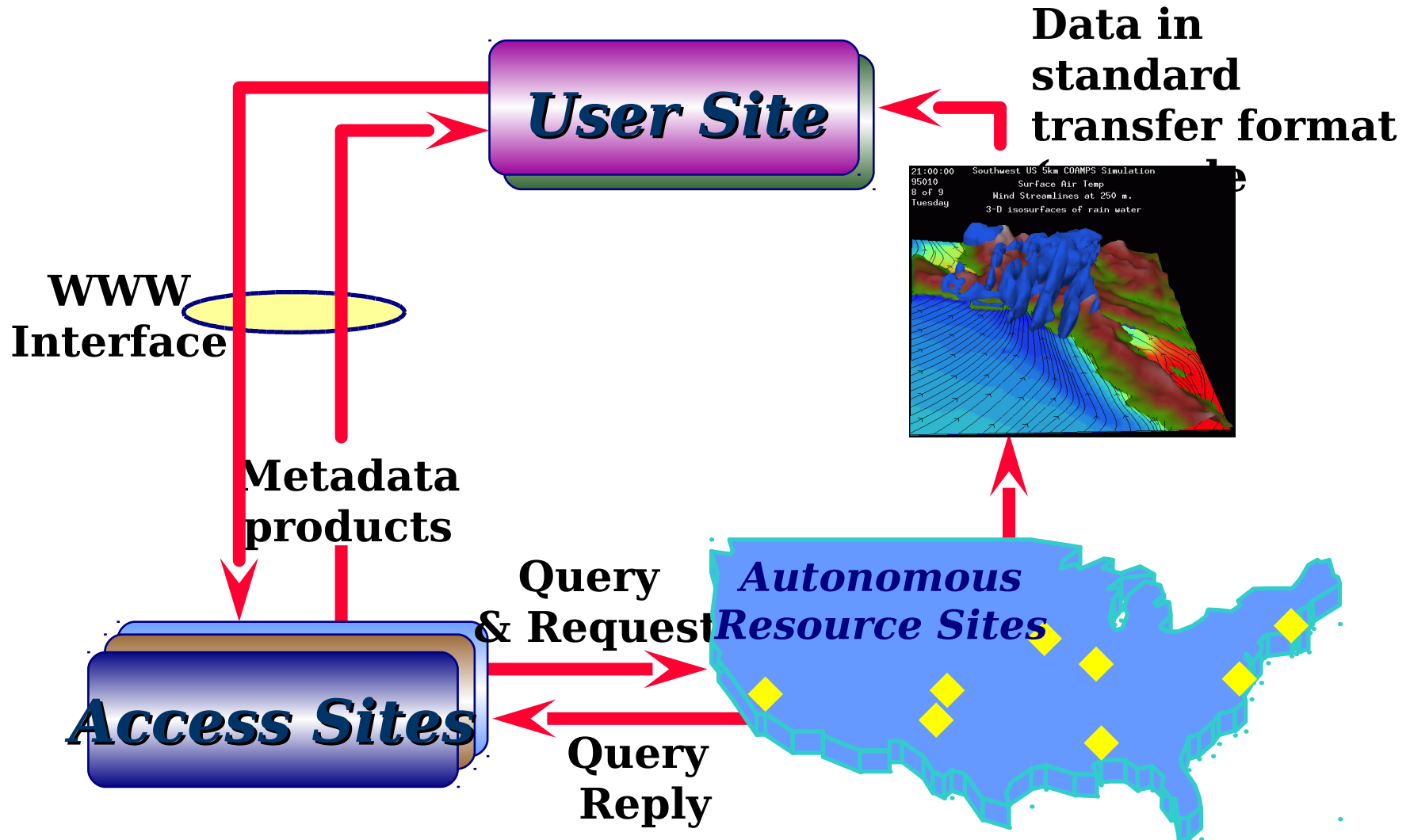


JAMES P. WOMACK, DANIEL T. JONES, AND DANIEL ROOS

**Revolutions in manufacture
are useful only if they are
available to everyone.**

James Womack, Daniel Jones, and Daniel Roos, The Machine That Changed The World: The Story of Lean Production. New York: Harper Perennial, 1991.

Master Environmental Library (MEL)



Three-Tier Architecture for Simple User Access

Commercial and International Activities

- **Much HLA interest in commercial arena**
 - commercial products are emerging
 - interests beyond defense
- **The Simulation Interoperability Standards Organization (SISO) was formed to serve the full breadth of the M&S community, beyond DoD**
 - will develop HLA as an IEEE standard
 - Simulation Interoperability Workshops each spring and fall
- **Foreign nations have begun to build HLA-based simulations**
 - 315 RTI foreign transfer requests as of 31 Jul 98
- **The NATO Military Committee and Conference of National Armament Directors (CNAD) have chartered a Steering Group on M&S**
 - completed first-ever NATO M&S Master Plan, including interoperability and reuse standards
 - HLA/Common Technical Framework accepted as a baseline
 - HLA workshop July 1997 in The Hague

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JAMES P. WOMACK, DANIEL T. JONES, AND DANIEL ROOS

... there are four basic differences in design methods employed by mass and lean producers. These are differences in leadership, teamwork, communication, and simultaneous development.

James Womack, Daniel Jones, and Daniel Roos, The Machine That Changed The World: The Story of Lean Production. New York: Harper Perennial, 1991.

Conclusion

PEOPLE are the most important ingredient to effective change

- They deliver the technology and transition it to better tools
- They train their colleagues in effective use
- They deliver the solutions to the warfighter's needs

PARTNERSHIPS are the only practical way ahead

- Strategic relationships tailored to application domain will increase

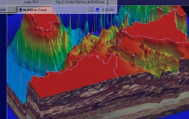
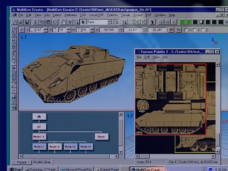
PRAGMATISM is necessary to discover the affordable way ahead

- Must satisfy today's needs better while preparing for an even better tomorrow

U.S. Defense Modeling and Simulation Office

Vision and Direction . . .

*Providing the Means for Interoperability
and Re-use for the Warfighter . . .*



DoD M&S Vision

1. In 1991, the Deputy Secretary of Defense assigned overall management responsibility of all DoD M&S to the USD(A), now the USD for Acquisition and Technology. To assist the USD(A) in managing DoD M&S, the USD(A) established the DoD EXCIMS and granted it oversight and management authority. The USD(A) tasked the EXCIMS to develop a vision for DoD M&S to help focus the DoD's M&S community on core functions. The EXCIMS focused on applying M&S in ways that would enhance overall U.S. military capability.
2. These ideas were incorporated by the EXCIMS into the DoD M&S vision:
 - a. Defense modeling and simulation will provide readily available, operationally valid environments for use by the DoD Components.
 1. To train jointly, develop doctrine and tactics, formulate operational plans, and assess wargaming situations.
 2. To support technology assessment, system upgrade, prototype and full-scale development, and force structuring.
 - b. Furthermore, common use of these environments will promote a closer interaction between the operations and acquisition communities in carrying out their respective responsibilities. To allow maximum utility and flexibility, these modeling and simulation environments will be constructed from affordable, reusable components interoperating through an open systems architecture.